

**Combinations and Permutations:**

1. In a classroom you have 20 students and you put all of their names in a bag. You have 13 boys and 7 girls in the class.

a. What is the probability of pulling three girls names at once?

$$\frac{7}{20} \cdot \frac{7}{20} \cdot \frac{7}{20} = \frac{343}{8000}$$

b. What is the probability of pulling two boy's names and 1 girl's name, all at once?

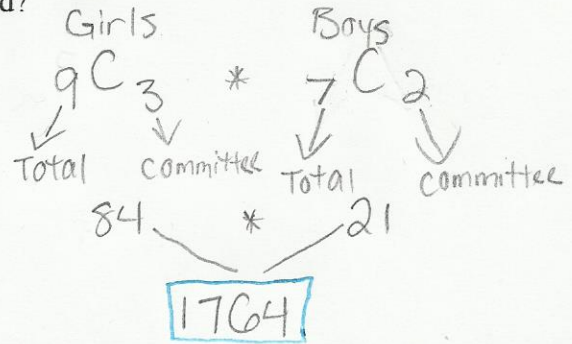
$$\frac{13}{20} \cdot \frac{13}{20} \cdot \frac{7}{20} = \frac{1183}{8000}$$

2. There are 16 members of the Math Honor Society. You must select a committee with a President, Vice President, Secretary, Treasurer, and Public Relations Manager. Assume that one person can only hold one position. How many different ways can the committee be formed?

16 members  
5 officers

$$16 P_5 = \frac{16!}{(16-5)!} = \frac{16!}{11!} = 524,160$$

b. If there are 9 girls and 7 boys on the ballot, how many committees of 2 boys and 3 girls can be formed?



3. How many different 7-digit telephone numbers are there if the first number cannot be zero, and the other numbers must be odd?

First Digit: 1-9 = 9 digits

Second through seventh Digits: 1, 3, 5, 7, 9 = 5 Digits

1st 2nd 3rd 4th 5th 6th 7th

$$9 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$$

$$= 140,625$$

**Independent Events**

4. A box contains 2 tennis balls, 4 golf balls, and 6 baseballs. What is the probability of selecting a golf ball? 12 balls total

$$\frac{4}{12} = \frac{1}{3}$$

5. In a bag of 14 M&Ms 6 are red and the rest are yellow. What is the probability of pulling 2 yellow M&Ms at once? 8 yellow M&Ms

$$\frac{8}{14} = \frac{4}{7}$$

$$\text{So, } \frac{4}{7} \cdot \frac{4}{7} = \frac{16}{49}$$

6. You order chili-cheese fries at a POB basketball game. Only 68% of the fries are covered in chili and cheese. If you don't look what is the probability of selecting a fry that does not have chili and cheese on it?

$$32\% = \frac{32}{100} \text{ or } \frac{8}{25}$$

7. You pull a card out of a deck and then replace it. What is the probability that the first card is a red card and the second card is a spade?

Red Cards (Hearts + Diamonds)  
 $\frac{13}{52} + \frac{13}{52} = \frac{26}{52}$   
reduces to  $\frac{1}{2}$

Spade  
 $\frac{13}{52}$   
reduces to  $\frac{1}{4}$

$$\frac{1}{2} \cdot \frac{1}{4} = \frac{1}{8}$$

8. You have a bag of 23 marbles. There are 11 orange marbles and the rest are green. What is the probability of not pulling a green marble replacing it and then pulling a orange marble?

12 green marbles  
11 not green  $\rightarrow \frac{11}{23} \cdot \frac{11}{23} = \frac{121}{529}$  (orange marbles)

**Dependent Events**

9. You have a bag of 7 tennis balls. 4 are yellow and 3 are pink. What is the probability of pulling a pink one then another pink one without replacement?

$\frac{3}{7} \cdot \frac{2}{6} = \frac{6}{42} \rightarrow \frac{1}{7}$   
 Pink ball not replaced  
 ball not replaced

10. A bag contains 5 yellow, 6 blue, and 4 white marbles. What is the probability of pulling a white, then a blue, and then another white, each without replacement?

$\frac{4}{15} \cdot \frac{6}{14} \cdot \frac{3}{13} = \frac{72}{2730} = \frac{12}{455}$   
 Original amt wh.  
 Original amt. blue  
 white not replaced  
 Original amt one not replaced

11. Jacob has 10 rap, 18 rock, 8 country, and 4 pop CDs in his music collection. Two are selected at random. Find each probability without replacement.

a. P(2 pop)

$\frac{4}{40} \cdot \frac{3}{39} = \frac{12}{1560}$   
 $\frac{1}{10} \cdot \frac{1}{13} = \frac{1}{130}$

b. P(Not rock)

$\frac{22}{40} \cdot \frac{21}{39} = \frac{462}{1560} \rightarrow \frac{77}{260}$

c. P(1 rap and 1 rock)

$\frac{10}{40} \cdot \frac{18}{39} = \frac{180}{1560}$   
 $\frac{1}{4} \cdot \frac{9}{13} = \frac{9}{52}$

12. Using a standard deck of cards find the probability without replacement of drawing 5 red cards.

$\frac{26}{52} \cdot \frac{25}{51} \cdot \frac{24}{50} \cdot \frac{23}{49} \cdot \frac{22}{48} = \text{eventually } \frac{253}{9996}$

**Compound Probability**

13. In a classroom of 21 students 4 earned As, 5 earned Bs, 7 earned Cs, 3 earned Ds and 2 earned Fs. What is the probability that a student selected at random passed with a C or better?

C's B's A's  
 $\frac{7}{21} + \frac{5}{21} + \frac{4}{21} = \frac{16}{21}$

14. Ms. Army was in a class of 14 students. 6 of them are blonde haired and 5 have a green eyes. Three of them have both blonde hair and green eyes. What is the probability that a student selected a random is either blonde haired or green eyed?

Blonde Hair Green Eyes Both  
 $\frac{6}{14} + \frac{5}{14} - \frac{3}{14}$   
 $= \frac{8}{14} \rightarrow \frac{4}{7}$

15. In a bag of coins there are 7 pennies, 4 dimes, and 5 nickels. What is the probability of selecting a nickel or a dime?

Nickels Dimes  
 $\frac{5}{16} + \frac{4}{16} = \frac{9}{16}$

16. What is the probability of rolling two numbered cubes and either one of them shows a 4?

36 options total  
 6 roll 4 first  
 6 roll 4 second  
 1 rolls 4 both  
 $\frac{6}{36} + \frac{6}{36} - \frac{1}{36} = \frac{11}{36}$

17. There are 5 male and 5 female students in the executive council of the Douglas High School honor society. A committee of 4 members is to be selected at random to attend a conference. Find the probability of selecting a committee of at least 3 females.

$10C_4 = 210 \rightarrow$  Denominator  
 Total Committee  
 $5C_3 \cdot 5C_1 = 50$   
 Total G committee G  
 $5C_4 = 5$   
 $50 + 5 = 55$   
 $= \frac{55}{210} = \frac{11}{42}$

18. While Shooting arrows, Akira can hit the center of the target 4 out of 5 times. What is the probability that he will hit it exactly 4 out of the next 7 times?

$P(H) = \frac{4}{5}$   
 $P(M) = \frac{1}{5}$   
 $(a+b)^7$   
 $\binom{7}{3} a^4 b^3$   
 $35 (\frac{4}{5})^4 (\frac{1}{5})^3 = 5310$

19. Find the 4th term of  $(2x+4y)^5$

$\binom{5}{r-1} = \binom{5}{4-1} = \binom{5}{3} (2x)^2 (4y)^3$   
 $= 10 \cdot 4x^2 \cdot 64y^3$   
 $= 2560x^2y^3$

**Conditional Probability**

20. A pair of number cubes are thrown. Find each probability given that their sum is greater than or equal to 9.

a. P(numbers match) *10 options where sum is greater than 9*

$\frac{2}{9}$

b. P(sum is even)

$\frac{4}{9}$

c. P(numbers match or sum is even)

$\frac{2}{9} + \frac{4}{9} - \frac{1}{9} = \frac{3}{9} \text{ or } \frac{1}{3}$

21. A dollar-bill changer in a snack machine was tested with 100 \$1-bills. Twenty-five of the bills were counterfeit. The results of the test are shown in the chart below.

Bill	Accepted	Rejected
Legal	69	6
Counterfeit	1	24

a. What is the probability that a bill accepted by the changer is legal?

$\frac{75}{100} \text{ or } \frac{3}{4}$

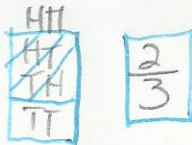
b. What is the probability that a bill is rejected given that it is legal?

$\frac{6}{75} \text{ or } \frac{2}{25}$

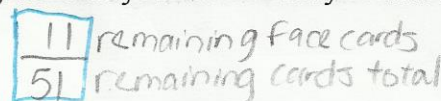
c. What is the probability that a counterfeit bill is not yet rejected?

$\frac{1}{25}$

22. Two coins are tossed. What is the probability that one coin shows heads if it is known that at least one coin is tails?



23. Using a standard deck of cards, you pull two cards. What is the probability of pulling a face card, given that you have already selected a queen?



24. In a class of aliens there are 70% of the students are purple, 20% have green eyes, and 10% are purple with green eyes. Calculate each probability:

a. The probability of selecting an alien that is purple given that they have green eyes.

b. The probability of selecting an alien that does not have green eyes, given that they are purple.

*Will go over in class tomorrow*